

# PATENT ABSTRACTS OF JAPAN

(11)Publication 09-233788

number :

(43)Date of 05.09.1997

publication of

application :

(51)Int.Cl.

H02K 19/36

H02K 19/26

(21)Application 08-055422

number :

(22)Date of 20.02.1996

filing :

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## (54) BRUSHLESS EXCITING DEVICE

(57)Abstract:

**PROBLEM TO BE SOLVED:** To provide an exciting device which can detect field current without having a mechanical contact section, by using electromagnetic induction by the flux of field current.

**SOLUTION:** The alternating current generated at an a.c. exciter is converted into direct current by a rotational rectifier 6, which is supplied to the field winding of a dynamo-electric machine through a d.c. copper strip 7. In a field current detector 9, the flux corresponding to field current passing through the d.c. copper band 7 in a detecting part 10 on the rotating side is generated, and field current is detected based on a magnetic circuit which the flux forms with no contact in a detecting part 11 on the stationary side.

### [Claim(s)]

[Claim 1] Brush loess exciting arrangement characterized by providing the following. The AC exciter which prepared the rotating armature in the outer-diameter side of the hollow shaft directly linked with the shaft of rotation electrical machinery, and prepared the quiescence magnetic pole in the circumference of an outside. The rotary rectifier which changes into a direct current the field voltage which was prepared in the bore side of the aforementioned hollow shaft, and was obtained by the aforementioned rotating armature. The direct-current copper belt for supplying the field current which was prepared in the bore side of the aforementioned hollow shaft, and was changed into a direct current by the aforementioned rotary rectifier to the field winding of the aforementioned rotation electrical machinery. Field current detection equipment which outputs the aforementioned field current to a quiescence side through the magnetic circuit which detects the magnetic flux according to the field current which flows the aforementioned direct-current copper belt, and the magnetic flux forms.

[Claim 2] Brush loess exciting arrangement according to claim 1 characterized by providing the following. The aforementioned field current detection equipment is a rotation side detecting element which generates the magnetic flux according to the field current which is prepared in the bore side of the aforementioned hollow shaft, and flows the aforementioned direct-current copper belt. The quiescence side detecting element which detects the aforementioned field current based on the magnetic circuit which the magnetic flux which was prepared in the aforementioned quiescence side the aforementioned rotation side detecting element and non-contact, and was detected by the aforementioned rotation side detecting element forms.

[Claim 3] The aforementioned rotation side detecting element consists of rotation side pole pieces which generate the magnetic flux proportional to the field current which flows the aforementioned direct-current copper belt. the aforementioned quiescence side detecting element The quiescence side pole piece which forms the magnetic circuit for leading the magnetic flux which it was prepared in the aforementioned quiescence side the aforementioned rotation side pole piece and non-contact, and was generated in the aforementioned rotation side pole piece to a quiescence side, Brush loess exciting arrangement according to claim 2 characterized by consisting of sensing coils for generating the voltage which interlinked with the magnetic flux drawn by the aforementioned quiescence side pole piece, and is proportional to the aforementioned field current.

[Claim 4] It is the brush loess exciting arrangement according to claim 3 which the aforementioned rotation side pole piece is projected and prepared in the direction of a path of a rotation electrical machinery shaft, and is characterized by forming the aforementioned quiescence side pole piece and the gap of the magnetic circuit formed in the direction of a path.

[Claim 5] It is the brush loess exciting arrangement according to claim 3 which the aforementioned rotation side

pole piece is projected and prepared in the shaft orientations of a rotation electrical machinery shaft, and is characterized by forming the aforementioned quiescence side pole piece and the gap of the magnetic circuit formed in the direction of a path.

#### DETAILED DESCRIPTION

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##### [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the brush loess exciting arrangement which attached the exciting arrangement of rotation electrical machinery in the rotation electrical machinery shaft, and was made to have no brush.

[0002]

[Description of the Prior Art] There is brush loess exciting arrangement as one of the exciting arrangement which supplies the field current of a direct current to the field winding of the rotation electrical machinery of revolving field type. This brush loess exciting arrangement attaches an AC exciter in the edge of a rotation electrical machinery shaft, obtains the example voltage of an alternating current, rectifies by the rotary rectifier, and is supplied to the field winding of rotation electrical machinery. Therefore, in brush loess exciting arrangement, in case an alternating current is changed into a direct current, it has structure which does not need a brush. The structure of such brush loess exciting arrangement is shown in drawing 4.

[0003] Drawing 4 shows the case of a steam turbine generator as rotation electrical machinery. The hollow shaft 2 is directly linked with the edge of the generator shaft 1, and an AC exciter is attached in this hollow shaft 2 so that drawing 4 may show. An AC exciter consists of an AC-exciter armature 3 and an AC-exciter magnetic pole 5. That is, the AC-exciter armature 3 is fixed to the outer-diameter side of the hollow shaft 2, and the AC-exciter magnetic pole 5 is attached in the frame 4 which is a quiescence side. The field winding was coiled around the iron core and this AC-exciter magnetic pole 5 is equipped with two or more pole pieces. Thus, the AC exciter of revolving-armature type is constituted.

[0004] And two or more rotary rectifiers 6 are attached in the position close to the AC-exciter armature 3. The ac output generated in the AC-exciter armature 3 by this rotary rectifier 6 is changed into a direct current. The changed direct current is supplied to the field winding currently coiled around the generator shaft 1 through the direct-current copper belt 7 by the side of exciting arrangement, and the direct-current copper belt 8 by the side of a generator. The exciting-arrangement side direct-current copper belt 7 is formed along with the bore side of the hollow shaft 2, and the generator side direct-current copper belt 8 is formed along the core of the generator shaft 1.

[0005] As mentioned above, brush loess exciting arrangement does not have a contact portion by the side of the quiescence for supplying a direct current which is looked at by thyristor exciting arrangement, and rotation, and since it is the structure separated mechanically, it has the advantage that a maintenance is easy.

[0006]

[Problem(s) to be Solved by the Invention] As mentioned above, while there is no mechanical contact portion by the side of the quiescence for supplying direct currents with which thyristor exciting arrangement etc. is equipped, such as the slip ring and a brush, to brush loess exciting arrangement as a structural feature, and rotation and it says that it is advantageous in respect of a maintenance, since the field current of a generator flows only to a rotation side, the fault that measurement of field current is difficult produces it.

[0007] The purpose of this invention is offering the brush loess exciting arrangement which can detect field current, without having a mechanical contact portion by using the electromagnetic induction by the magnetic flux of field current.

[0008]

[Means for Solving the Problem] The AC exciter which invention of a claim 1 prepared the rotating armature in the outer-diameter side of the hollow shaft directly linked with the shaft of rotation electrical machinery, and prepared the quiescence magnetic pole in the circumference of an outside, The rotary rectifier which changes into a direct current the field voltage which was prepared in the bore side of a hollow shaft and was obtained by the rotating armature, The direct-current copper belt for supplying the field current which was prepared in the bore side of a hollow shaft and was changed into a direct current by the rotary rectifier to the field winding of rotation electrical machinery, It has field current detection equipment which outputs field current to a quiescence side through the magnetic circuit which detects the magnetic flux according to the field current which flows a direct-current copper belt, and the magnetic flux forms.

[0009] In invention of a claim 1, the alternating current generated in the AC exciter is changed into a direct current by the rotary rectifier, and the field winding of rotation electrical machinery is supplied through a direct-current copper belt. Field current detection equipment detects the field current which flows to a direct-current copper belt as magnetic flux, and outputs it to a quiescence side by non-contact through a magnetic circuit.

[0010] Invention of a claim 2 is equipped with the quiescence side detecting element which detects field current based on the magnetic circuit which the rotation side detecting element which generates the magnetic flux according to the field current which field current detection equipment is formed in the bore side of a hollow shaft, and flows a direct-current copper belt, and the magnetic flux which was prepared in the quiescence side a rotation side detecting element and non-contact, and was detected by the rotation side detecting element form in invention of a claim 1.



[0011] In invention of a claim 2, the magnetic flux according to the field current which flows a direct-current copper belt in a rotation side detecting element is generated, and field current is detected based on the magnetic circuit which the magnetic flux forms by non-contact in a quiescence side detecting element.

[0012] Invention of a claim 3 is set to invention of a claim 2. a rotation side detecting element It consists of rotation side pole pieces which generate the magnetic flux proportional to the field current which flows a direct-current copper belt. a quiescence side detecting element It consists of sensing coils for generating the voltage which interlinked with the quiescence side pole piece which forms the magnetic circuit for leading the magnetic flux which it was prepared in the quiescence side a rotation side pole piece and non-contact, and was generated in the rotation side pole piece to a quiescence side, and the magnetic flux drawn by the quiescence side pole piece, and is proportional to field current.

[0013] In invention of a claim 3, the magnetic flux generated in the rotation side pole piece is led to a quiescence side pole piece by non-contact through the formed magnetic circuit, and a sensing coil generates the voltage according to field current based on the magnetic flux led to the quiescence side pole piece. Now, field current is detected.

[0014] Invention of a claim 4 projects a rotation side pole piece in the direction of a path of a rotation electrical machinery shaft in invention of a claim 3, it is prepared, and the gap of a quiescence side pole piece and the magnetic circuit formed is formed in the direction of a path.

[0015] In invention of a claim 4, a rotation side pole piece generates magnetic flux in the direction of a path of a rotation electrical machinery shaft, and a quiescence side pole piece detects the magnetic flux of the direction of a path.

[0016] Invention of a claim 5 projects a rotation side pole piece to the shaft orientations of a rotation electrical machinery shaft in invention of a claim 3, it is prepared, and the gap of a quiescence side pole piece and the magnetic circuit formed is formed in the direction of a path.

[0017] In invention of a claim 5, a rotation side pole piece generates magnetic flux in the shaft orientations of a rotation electrical machinery shaft, and a quiescence side pole piece detects the magnetic flux of shaft orientations.

[0018]

[Embodiments of the Invention] Hereafter, the gestalt of operation of this invention is explained. Drawing 1 is structural drawing showing the gestalt of operation of the 1st of this invention. The gestalt of this 1st operation forms field current detection equipment 9 to the conventional example shown in drawing 4.

[0019] In drawing 1, the hollow shaft 2 is directly linked with the edge of the generator shaft 1, and an AC exciter is attached in this hollow shaft 2. An AC exciter consists of an AC-exciter armature 3 and an AC-exciter magnetic pole 5. That is, the AC-exciter armature 3 is fixed to the outer-diameter side of the hollow shaft 2, and the AC-exciter magnetic pole 5 is attached in the frame 4 which is a quiescence side. The field winding was coiled around the iron core and this AC-exciter magnetic pole 5 is equipped with two or more pole pieces. Thus, the AC exciter of revolving-armature type is constituted.

[0020] And two or more rotary rectifiers 6 are attached in the position close to the AC-exciter armature 3. The ac output generated in the AC-exciter armature 3 by this rotary rectifier 6 is changed into a direct current. The changed direct current is supplied to the field winding currently coiled around the generator shaft 1 through the direct-current copper belt 7 by the side of exciting arrangement, and the direct-current copper belt 8 by the side of a generator. The exciting-arrangement side direct-current copper belt 7 is formed along with the bore side of the hollow shaft 2, and the generator side direct-current copper belt 8 is formed along the core of the generator shaft 1.

[0021] Field current detection equipment 9 detects the magnetic flux according to the field current which flows the exciting-arrangement side direct-current copper belt 7, outputs it to a quiescence side, and is formed in the bore side of the hollow shaft 2. That is, field current detection equipment 9 consists of a rotation side detecting element 10 which generates the magnetic flux according to the field current which flows the exciting-arrangement side direct-current copper belt 7, and a quiescence side detecting element 11 which detects field current based on the magnetic flux detected by this rotation side detecting element 10. And the quiescence side detecting element 11 is formed in the quiescence side to the rotation side detecting element 10 and non-contact, and introduces the magnetic flux detected by the rotation side detecting element 10 through a minute opening (gap).

[0022] Drawing 2 is the perspective diagram of field current detection equipment 9. The rotation side detecting element 10 consists of rotation side pole piece 10a of the couple which generates the magnetic flux proportional to the field current which flows the exciter side direct-current copper belt 7 which is a rotation side. the quiescence side detecting element 11 It consists of sensing-coil 11b for generating the voltage which interlinked with the magnetic flux drawn by quiescence side pole piece 11a of the couple for leading the magnetic flux generated in rotation side pole piece 10a to a quiescence side, and this quiescence side pole piece 11a, and is proportional to field current.

[0023] That is, in the exciting-arrangement side direct-current copper belt 7 near the connection of the exciting-arrangement side direct-current copper belt 7 and the generator side direct-current copper belt 8, rotation side pole piece 10a is attached in the position which sandwiches the exciting-arrangement side direct-current copper belt 7 by the side of the bore of the hollow shaft 2 toward the shaft orientations of the hollow shaft 2. Moreover, corresponding to the rotation side pole piece 10a, quiescence side pole piece 11a is attached in the quiescence side, and the magnetic circuit is formed through a minute opening. And sensing-coil 11b for generating the voltage according to the magnetic flux which flows a magnetic circuit is being fixed to quiescence side pole piece 11a.

[0024] Sensing-coil 11b is being fixed to a position where rotation side pole piece 10a which sandwiches the exciting-arrangement side direct-current copper belt 7, and quiescence side pole piece 11a which attached sensing-coil 11b separate an on stream and very small gap, and passes.

[0025] If it does in this way, the moment rotation side pole piece 10a and quiescence side pole piece 11a pass each other, the magnetic flux of the shape of a pulse which has a size proportional to field current as shown in the solid line in drawing 1 or drawing 2 in sensing-coil 11b \*\*\*\*. Therefore, in the output terminal of sensing-coil 11b, the pulse-voltage wave of the size which is proportional to a flux linkage, i.e., field current, by electromagnetic induction occurs. Thereby, the value of generator-field current can be known by seeing the size of this voltage waveform.

[0026] Although field current detection equipment 9 is projected and formed in the shaft orientations of the generator shaft 1 with the gestalt of this 1st operation here, it is made to form the gap (gap) in which rotation side pole piece 10a and quiescence side pole piece 11a form a magnetic circuit in the direction of a path of the generator shaft 1. Since this contracts a turbine shaft and a generator shaft with heat, it is for making it the gap of a magnetic circuit not change to the heat elongation of the shafting. That is, in order to prevent contact of each pole pieces by change of gap length, it is made for each pole piece to form the gap which forms a magnetic circuit in the direction of a path instead of shaft orientations with the gestalt of the 1st operation, as shown in drawing 1.

[0027] Since according to the gestalt of this 1st operation a rotation side pole piece and a quiescence side pole piece can be constituted in non-contact and field current can be detected as stated above, the reliability of operation of rotation electrical machinery improves.

[0028] Next, the gestalt of operation of the 2nd of this invention is shown in drawing 3. The gestalt of this 2nd operation projects and forms field current detection equipment 9 in the direction of a path of the generator shaft 1 to the gestalt of the 1st operation shown in drawing 1. Namely, in the gestalt of the 1st operation shown in drawing 1, although field current detection equipment 9 is projected and formed in the shaft orientations of the generator shaft 1, it has projected and formed field current detection equipment 9 in the direction of a path of the generator shaft 1 with the gestalt of this 2nd operation.

[0029] In this case, since rotation side pole piece 10a is attached toward the direction of a path and the gap of a magnetic circuit can be formed in the direction of a path as it is, change of the gap length to the heat elongation of the shafting of a turbine shaft or a generator shaft and contact of pole pieces can be prevented.

[0030] Thus, in this invention, it becomes possible to detect the field current which flows to main rotation electrical machinery field Rota according to very easy structure, without preparing a mechanical contact portion.

[0031]

[Effect of the Invention] As explained above, according to this invention, in the rotation electrical machinery of the revolving field type which has brush loess exciting arrangement, it becomes possible to detect field current easily, and reliability on stream improves.

[0032] That is, a rotation side pole piece is attached in the position which sandwiches the exciting-arrangement side direct-current copper belt of a hollow shaft bore, a quiescence side pole piece with the sensing coil is attached in a quiescence side, it fixes to a position which separates a gap with very small rotation side pole piece and quiescence side pole piece, and passes, and the sensing coil prepared in the quiescence side pole piece detects field current. Therefore, detection of field current can be performed easily, without preparing a mechanical contact portion.

## DESCRIPTION OF DRAWINGS

### [Brief Description of the Drawings]

[Drawing 1] Structural drawing showing the form of operation of the 1st of this invention.

[Drawing 2] The perspective diagram showing the field current detection equipment of this invention.

[Drawing 3] Structural drawing showing the form of operation of the 2nd of this invention.

[Drawing 4] Structural drawing showing the example of \*\*\*\*.

### [Description of Notations]

1 Generator Shaft

2 Hollow Shaft

3 AC-Exciter Armature

4 Frame

5 AC-Exciter Magnetic Pole

6 Rotary Rectifier

7 Exciting-Arrangement Side Direct-Current Copper Belt

8 Generator Side Direct-Current Copper Belt

9 Field Current Detection Equipment

10 Rotation Side Detecting Element

10a Rotation side pole piece

11 Quiescence Side Detecting Element

11a Quiescence side pole piece

11b Sensing coil

DRAWINGS



